

Piezoelectric Nanogenerator for Self-Powered, Energy-Harvesting Sensors (#8343)

Transforms mechanical energy into electrical energy

Researchers have developed a flexible piezoelectric nanogenerator that transforms mechanical energy into electrical energy. The innovation is composed of a piezoelectric structure sandwiched on both sides by insulation layers and flexible electrodes. Zinc oxide (ZnO) nanowire arrays are grown on an ultrathin aluminum (Al) foil, which is used as both the electrode and the substrate and has been insulated with a polymethyl methacrylate (PMMA) layer.

The device harvests mechanical energy generated by dynamic motion existing in its environment (e.g., light wind) regardless of its level of activity due to its excellent conformability. It can also be used as an active sensor to detect motion of the human body (e.g., muscle stretching, blood flow), external environmental changes, and microscopic motion.

Benefits/Advantages

- **Cost-effective:** Uses lower cost ultrathin Al-foil electrodes
- **Flexible:** Adapts to shape changes due to its super-flexible and conformable properties, enabling the harvesting of mechanical energy from a variety of external sources
- **Self-powered:** Derives energy from its environment, requiring no maintenance

Potential Commercial Applications

- Renewable energy
- Sensors
- Medical devices
- Small electronics

Background/Context for This Invention

Renewable and green energy sources are needed for sustainable, maintenance-free, and continuous operation of small-scale electronics, such as implantable biosensors, nanorobotics, and mobile environmental sensors. The research team has developed nanogenerators that operate not only as self-sufficient power sources for micro- and nano-systems but also as self-powered sensors for detecting motion, vibration, or any mechanical disturbance. This super-flexible and conformable nanogenerator can not only enable energy harvested from a waving flag but also detect skin movement when attached to a human face.

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More Information

U.S. Patent Issued - [U.S. 9,112,432](#)

Publications

[*Energy Harvesting Materials: Super-Flexible Nanogenerator for Energy Harvesting from Gentle Wind and as an Active Deformation Sensor*](#), Advanced Functional Materials, May 13, 2013

For more information about this technology, please visit:

<https://licensing.research.gatech.edu/technology/piezoelectric-nanogenerator-self-powered-energy-harvesting-sensors>

Images:

The automated sequential delivery of multiple fluids. A varying number of delay gates imprinted in the branches are shown in the figure.

COVID-19 and flu saliva test on paper: (A) The automatic sequential delivery of multiple reagents required for virus test; (B) Water pouring into the device triggers the virus assay, allowing the presence of SARS-CoV-2 and influenza A & B viruses to be visually identified by the color changes in the corresponding detection spot

